

TESTIMONY OF
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Good morning, Chairman Duncan and Chairman LoBiondo and members of the Subcommittees. I am Timothy Keeney, Deputy Assistant Secretary of Commerce for Oceans and Atmosphere. I appreciate the opportunity on behalf of the Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA) to present testimony on NOAA's activities to implement the National Invasive Species Act of 1996 (NISA).

Today, I will provide a description of the nonindigenous species problem, collaborative research and development efforts on technology, outreach and education activities, and scientific results. I will then describe the responsibilities of NOAA under the Act, and the progress we have made in the aforementioned areas. Because of the Committee's interest in transportation issues, the primary focus of my testimony is on ballast water as the major vector for nonindigenous species introductions.

The challenge associated with aquatic invasive species has changed significantly since the passage of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. Understanding of the problems caused by aquatic invasive species has expanded, and the impacts are much more serious than were originally thought. In 1990, the focus of the Nonindigenous Aquatic Nuisance Prevention and Control Act was on a single species—the zebra mussel, a single region—the Great Lakes, and a single vector—ballast water. We now know that the zebra mussel invasion was not an anomaly but rather, the beginning of a serious and ongoing problem.

Even though zebra mussels were the proximate cause of the initial legislation, I think Congress deserves credit for being prescient in 1990. It would have been possible to pass a Zebra Mussel Control Act at that time but instead, Congress recognized that broader issues were involved. Congress passed legislation that was multi-species in scope in 1990, and then expanded the authorization with the passage of the National Invasive Species Act in 1996. The legislation required NOAA and the other members of the Aquatic Nuisance Species Task Force to examine

the threats posed by multiple aquatic invasive species and take steps to tackle the problem.

Aquatic invasive species, many of which are introduced in ballast water exchange, can severely affect marine and coastal resources. For example, the veined rapa whelk, a predatory gastropod, may affect bivalve fisheries that are already stressed by disease in the Chesapeake Bay.

Introduced Chinese mitten crabs and green crabs have already impacted west coast fisheries. The Australian spotted jellyfish has affected the shrimp fishery in the Gulf of Mexico, and introduced algal species are smothering coral reefs in Hawaii.

Ballast water is the most significant vector of introduction for aquatic invasive species worldwide. A recent analysis of invasion patterns in coastal marine communities conducted by the Smithsonian Environmental Research Center and its partners has implicated shipping as the vector for over two-thirds of species introductions. The rate of introduction continues to increase with expansion of trade and the speed of transportation.

There are also lesser-known vectors other than ballast water that provide the means by which aquatic invasive species invade. For example, recent information has shown that semi-submersible oil platforms can carry entire ecosystems to an area if relocated. NOAA's Flower Garden Banks National Marine Sanctuary is concerned that a species introduced by such platforms may affect the Sanctuary's reefs. Other examples of vectors are recreational boating, aquarium releases, and live-bait introductions.

Mid-ocean exchange was the only practical means of reducing the number of potentially invasive species in ballast water when the 1990 Act became law. To address the serious limitations to mid-ocean ballast water exchange, Congress initiated a competitive research program by adding §1104 of the National Invasive Species Act of 1996. This program was designed to encourage the development of new technologies for managing ballast water.

The ballast water management demonstration program has funded projects covering all stages of technology development and demonstration, from bench-scale investigations through pilot scale demonstrations, to full-scale field tests on ships engaged in commercial activity. Under this program, NOAA and the U.S. Fish and Wildlife Service jointly invite proposals annually to develop and demonstrate new ballast water technologies. To date, the program has funded 20 ballast water technology demonstration projects involving total expenditures of \$3.5 million since 1998. The announcement of opportunity for the next annual ballast water grant competition will appear shortly in the *Federal Register*.

NOAA has funded nine additional ballast water research projects at the cost of \$1.5 million through the more general aquatic nuisance species competitive grant program administered by the National Sea Grant College Program under §1202(f) of the Act. Sea Grant encourages proposals for the development of ballast water treatment technologies under this program, and coordinates with the NOAA/Fish and Wildlife Service ballast water management demonstration program to ensure that the efforts are complementary.

All but one of the shipboard ballast treatment techniques discussed in the 1996 National Research Council report, *Stemming the Tide: Controlling Introductions of Nonindigenous Species by Ships' Ballast Water*, as “promising” or “with possible limited application” have had at least one shipboard test sponsored by the joint NOAA and U.S. Fish and Wildlife Service program, or similar state, federal, international or private programs. Research on newly developed technologies that have arisen since the report was published has also been conducted. Since 1998, the technologies being investigated have matured so that more projects involve full-scale tests of ballast water treatment equipment and fewer involve small laboratory scale experiments. These shipboard tests have brought us significantly closer to the development of mature ballast water treatment technologies, but none of these technologies is ready for widespread use by the maritime fleets of the world.

New questions and engineering issues have been generated from this research. Many of these issues remain to be resolved despite promising research results. For example:

- Filtration may remove particles and organisms down to 50 microns in size, but methods to prevent clogging of filters while handling vast quantities of ballast water need to be improved;
- Ozone injection is effective in killing a wide range of organisms in ballast water, but questions remain about why some organisms are not killed, and whether ozone or its byproducts cause tank corrosion or other problems;
- Ultraviolet irradiation experiments that showed good results in freshwater treatment were less effective when saline water was treated; and
- A particular biocide which appears to be effective at low concentrations seems to lose its effectiveness if there is significant sediment in the ballast water sample.

The shipboard test results have revealed gaps in relatively basic science that must be addressed before new technologies can be fully utilized. For example, researchers who are trying to use filtration and centrifugation to physically separate organisms from water do not know how successful they are because of the difficulty determining how many unseparated organisms are still alive after the separation process. Also, full-scale ultraviolet irradiation or ozone delivery system tests are limited by the lack of data for some aquatic organisms as to the UV or ozone dosage required to eradicate the species.

Despite these gaps, significant technology advancements have been made as a result of this work. This success is due in large part to the cooperative effort among a number of Federal agencies on the whole range of ballast water issues. Other Federal agencies that are involved include the U.S. Coast Guard, the Environmental Protection Agency, the Maritime Administration, and the U.S. Geological Survey.

Although NOAA and the Fish and Wildlife Service have taken the lead in funding ballast water

technology research, we have worked closely with our other partners in a number of ways, including:

- **Resource Pooling.** As mentioned above, each year NOAA and the Fish and Wildlife Service pool their grant funds and conduct a joint ballast water demonstration competition. More than funding is required to conduct research. As more ballast water technologies approach maturity, there will be an increasing need for operational ships on which these technologies can be tested. Some researchers have teamed up with private shipping interests to conduct tests aboard commercial ships, but the number of ships made available in this manner is limited, and the ability to conduct tests is constrained by the operational demands on a ship. To accommodate the need for ships to serve as test platforms, the U.S. Maritime Administration (MARAD) has teamed up with NOAA and the Fish and Wildlife Service. MARAD deserves special recognition for this help, though they have no explicit responsibility under the Act. This year, the ballast water demonstration competition will be a joint NOAA/Fish and Wildlife Service/MARAD program that will allow researchers to apply, not only for grant funding from NOAA or the Fish and Wildlife Service, but also for use of a ship from the MARAD ready reserve fleet to serve as an experimental test platform.
- **Priority setting and project selection.** Section 1202 of the National Invasive Species Act calls for the Aquatic Nuisance Species Task Force to “identify the goals, priorities, and approaches for aquatic nuisance species prevention, monitoring, control, education and research to be conducted or funded by the Federal Government.” To assist in the effort, the Task Force has a standing Ballast Water and Shipping Committee, chaired by the Coast Guard and on which sit representatives from Federal (including NOAA, EPA, USDA, and the Navy), Canadian, and state agencies; industry (including the Chamber of Shipping of America, Lake Carriers Association, American Petroleum Institute and the Pacific Merchant Shipping Association); and non-governmental organizations (including the Ocean Conservancy and the Prince William Sound Regional Citizens Advisory Committee). This Committee has recommended national ballast water research priorities. In addition, in accordance with §1203 of the National Invasive Species Act, Regional Panels of the Task Force have been created to identify regional invasive species priorities. Each of the existing Regional Panels has been approached about developing a list of regional ballast water research priorities, and several have done so. The annual NOAA/Fish and Wildlife Service ballast water technology demonstration program uses these published national and regional priorities as part of the proposal selection process, and asks technical experts from the organizations represented on the Task Force, the Ballast Water and Shipping Committee, and the Regional Panels to sit on the Selection Panel for proposals received.
- **Ballast water program collaborations.** NOAA recently hosted a meeting of all federally-funded investigators of ballast water technology and their federal sponsors. The purpose of the meeting was to present the state of the art in ballast water treatment science and technology, to promote technical interactions and encourage collaborative

programs. Among the joint programs that came out of this meeting were: a future NOAA/MARAD workshop to educate research scientists in the physical and logistical constraints in putting new technologies on ships; the formation of a Navy/NOAA/MARAD subgroup to address technology transition and scale-up issues; an agreement among all Federal sponsors to meet regularly to discuss progress and priorities; an annual technical meeting of ballast water investigators, to which all Federal sponsors will encourage participation by their grantees (e.g., by encouraging investigators to set aside travel funds for this meeting in their project budgets).

- **Joint technical projects.** Since the last reauthorization, awareness has risen of a new ballast water issue—that of ships entering U.S. waters in no-ballast-on-board (NOBOB) status. Although a ship may be in NOBOB status, it can still transport aquatic invasive species in the residual sediment that is found at the bottom of a ship’s ballast tanks. A ship in NOBOB status is not required to perform any regulated ballast procedures. This issue has been of particular concern in the Great Lakes region, where over three-fourths of the ships entering the system are in NOBOB status, but the problems of NOBOB ships are valid elsewhere as well. Because of this problem, the NOAA Great Lakes Environmental Research Laboratory initiated an investigation of the risks posed by NOBOB vessels. The investigation was a partnership with funding, participation, or other resources provided by NOAA, the Coast Guard, EPA, the Smithsonian Environmental Research Center, the Great Lakes Protection Fund, and academia from both countries bordering the Great Lakes. Recognizing the potential for NOBOB ships to pose problems elsewhere, the NOAA/Fish and Wildlife Service program has also funded a grant to conduct a complementary study of the NOBOB situation in the Chesapeake Bay.

Despite the fact that no single technology has emerged as a “silver bullet” that can reliably remove or kill all nonindigenous organisms on all ships, progress continues to be made. It is likely that no single ballast water technology will work best on all ships in all situations, and the development of ship-ready systems may prove to be an incremental process.

As the throughput of filtration systems is increased through research and design improvements, for example, filtration may become a viable technology for ships of progressively larger ballast capacity. As the study of the interactions of water, sediment, and living organisms becomes more advanced, effective treatment for ships in NOBOB status will become more of a reality.

Continued work is needed in all areas of ballast water technology research, development, testing, and ultimately, large-scale field implementation. Basic research questions continue to arise that must be addressed at the same time that the most mature technologies are developed for field use.

Interagency coordination must continue, as must cooperation with state agencies and non-governmental organizations. As technologies come closer to being market-ready, the essential role of the private sector in supporting technology development must continue and increase. The United States must continue to be a leader in the international technical and legal discussions surrounding ballast water management. U.S. Federal Agencies (led by the USCG) are working

together to develop an international agreement through the International Maritime Organization (IMO) for introduction at a diplomatic conference in 2003 to control the spread of invasive species in ballast water. As mentioned before, there is not a completely viable technology either in the U.S. or in other countries. The primary method in use today, ballast water exchange, has ship safety problems and unknown effectiveness. The Convention is based upon a U.S. submission to IMO made last year, and most recently, the U.S. led a well-regarded IMO Correspondence Group aimed at furthering development of a ballast water discharge standard.

As we approach the time when we can declare victory over invasive species in ballast water, other pathways related to marine transportation need to be given increasing consideration, including ballast tank sediment in NOBOB ships, fouling on ship hulls, and slow moving barges or oil rigs that can bring entire ecosystems with them as they are moved.

Together with the U.S. Fish and Wildlife Service, NOAA is the co-chair of the interagency Aquatic Nuisance Species Task Force. The Task Force has responsibilities for prevention, monitoring, and control of aquatic nuisance species. To support these functions, the Act requires research and education activities. NOAA is a leader in both areas.

On the education front, NOAA has been looking at other vectors ranging from live seafood to recreational users. As an example, NOAA was approached by the live bait industry in the Great Lakes because there were indications that other states would prohibit the importation of live bait because of the fear that live bait shipments might be contaminated with zebra mussels and other species. To address this problem, the Sea Grant College Program developed a training program for live bait dealers that would enable them to prevent such introductions. The manual and training program is based on a concept developed in the food industry and is called the Hazard Analysis and Critical Control Point methodology. The program has been widely adopted by members of the wild-caught live bait industry. The results have been impressive enough that the U.S. fish and Wildlife Service has asked NOAA to provide training in each of its regions for hatchery operators.

Although the zebra mussel traveled to the United States in ballast water, after it arrived here one of the major vectors for its spread has been on recreational boats. In response, the Task Force developed a series of voluntary guidelines for recreational users and sponsored a web site called “www.protectourwaters.net,” which highlights the voluntary guidelines and uses the slogan “Stop aquatic hitchhikers!” to drive the message home. Several of the agencies on the Task Force including NOAA and the U.S. Fish and Wildlife Service have made a concerted effort to educate people on the importance of cleaning their boats. I would be remiss if I did not mention one of the major successes that has been sponsored by one of our partners on the Task Force. The U.S. Fish and Wildlife Service has worked with both State and provincial governments to prevent the spread of zebra mussels on boats west of the 100th meridian. The effort involves everything from boat inspections on the major east-west highways to an extensive publicity campaign. Not only have they been successful in preventing the spread of zebra mussels to western states, but it has probably had the added benefit of reducing the spread of aquatic weeds.

The Sea Grant College Program has also made a major effort to educate recreational boaters, and the good news is that an aggressive publicity campaign can have results. Minnesota Sea Grant recently conducted a survey of boaters in five states and found that an aggressive publicity campaign not only raised awareness, but it also changed behaviors, and far more people were cleaning their boats.

The Sea Grant education effort has not been limited to recreational boaters. Projects have ranged from developing curricula for elementary and secondary students to providing shippers with information on best ballast water management practices to setting up a technical library—the National Aquatic Nuisance Species Clearinghouse—which contains both published and “gray” literature on various species. Available materials run the gamut from posters and fliers to videos to training courses.

Under the National Invasive Species Act, the NOAA National Sea Grant College Program bears much of the responsibility for research on aquatic invasive species. Originally, most of the sponsored research was focused on zebra mussels, but as other aquatic invasive species have been identified, the scope of these research projects has been significantly expanded. Over the last four years, the program has funded research on 34 different species. During the period 1999-2000 alone, Sea Grant funded 60 different projects. An effort was made to address each of the priorities identified in the Act and fund research projects in the areas of prevention, monitoring, and control.

Individual Sea Grant colleges and institutions also consider aquatic nuisance species so significant that they have sponsored approximately \$600,000 in projects out of their core funds in each of the last two years. For example, the Great Lakes Environmental Research Laboratory has conducted extensive research on the ecological impacts of invasive species in the Great Lakes, and, as mentioned earlier, has been leading the effort on NOBOB. NOAA’s Center for Coastal Environmental Health and Biomolecular Research in Charleston, SC, is currently studying the link between ballast water discharges and the presence of cholera in coastal waters, and in developing analytical tools to better identify the region of origin of any waterborne cholera found.

In a very real sense, NOAA has played a major role in defining the research agenda on aquatic nuisance species. At the international scientific conference on marine bioinvasions last year, an estimated two-thirds of all papers were presented by U.S. scientists who had received at least partial funding through NOAA.

NOAA has sponsored research on control methods for aquatic species ranging from emergent aquatic vegetation such as *Spartina* on the west coast and *Phragmites* on the east coast to periwinkles in San Francisco Bay. We have explored everything from diseases and parasites which may be species specific to pesticides to mechanical removal. While the total number of successful marine eradications probably can be counted on one hand, NOAA has been involved in three: 1) Sea Grant funds were used to eradicate an abalone parasite introduced from South Africa, 2) The National Aquatic Nuisance Species Clearinghouse provided Australia with

information that allowed it to eradicate an incipient mollusk invasion, 3) Finally, NOAA is partnering with other Federal agencies and the State of California in an ongoing project to eradicate an extremely invasive algal species from a lagoon near San Diego, California.

Mr. Chairman Duncan and Chairman LoBiondo, and members of the Subcommittees, we at NOAA take very seriously our responsibilities as stewards of our Nation's aquatic resources, including fisheries, marine sanctuaries, and marine endangered species, and are very grateful to Congress for recognizing the threat to these resources posed by invasive species. I think that NOAA can point to significant achievements since the original passage of legislation to deal with aquatic invasive species. It would be naive to assume that the problems have been solved, however. Much work remains to be done, and NOAA is committed to continuing our efforts in this area. Thank you for allowing me the opportunity to present the Administration's views on this topic. This concludes my testimony, and I would be happy to answer any questions you may have.